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THE ROLE OF FEEDBACK IN A DYNAMICALLY STABLE
ECONOMIC SYSTEM

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DYNAMICALLY STABLE ECONOMIC SYSTEM

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INTRODUCTION

No one can deny that the U.S. economy is becoming more predictable than it once was--more predictable in the sense that it is no longer generating the technological surprises it did during the first half of this century. But at the same time it has become a more unstable economy: in order to deal with double digit inflation, much more serious downturns are required in order to dampen the rate of inflation.

How can an economy become simultaneously more predictable and less stable? It is commonly believed that a stable economic system must be as predictable as the planets. That stability and predictability go hand in hand, we are told, is no more than common sense. But is it common sense? In the changes it made in its product line, Chrysler was certainly a far more predictable company after World War II than it was during the 20's and 30's. Yet, at the same time that Chrysler became a more predictable system it became a more unstable system. In the 30's it was taking business away from Ford and General Motors, but now it is asking the government for a loan.

Or to consider an even larger economic system--in displaying the lowest rate of productivity growth for more than one hundred years the British economy has been the most predictable of all the

ABSTRACT

Generally speaking, the stimuli to various types of technological change are associated with two types of anticipated feedback: hidden hand feedback (the possibility of making higher profits) and hidden foot feedback (the possibility of being dislodged from a successful market by the process of creative destruction). In this paper it is argued that the most significant gains in productivity result from hidden foot rather than hidden hand feedback. Moreover, it is also argued that the disappearance of such feedback has not only contributed to the productivity slowdown, but also to providing the economy with a very unique kind of inflationary bias in which inflationary pressures are likely to reach their maximum strength when the economy is headed into a downturn. Finally, various measures to restore the dynamic stability of the economy are considered.

industrialized countries. But from the point of view of being able to weather the current economic storm, it is in much the same position as Chrysler.

It is true, of course, that in an imaginary, unchanging world economies can be predictable both in the small and in the large: that is, they can survive simply by taking the classical law of supply and demand as a given. However, if an economic system is to make smooth adjustments in dealing with new circumstances--if it is to remain predictable in the large, so to speak--it must be able to adapt itself to new circumstances. In fact, what I mean by "dynamic" is the ability of a person, a firm or an economy to adapt itself to new circumstances by generating new alternatives. But, it should be apparent that if predictability in the small is defined as "microstability" and predictability in the large as "macrostability" neither an individual firm nor an entire economy can simultaneously conserve its micro and macrostability. Only in heaven can microstability be equated to macrostability. Here on earth, the greater the insistence on microstability--the greater the insistence on preserving a way of life--the lower will be its macrostability. Conversely, if a system is to enjoy a high degree of macrostability it must enjoy the ability to generate new alternatives, when confronted by necessity. In other words, whereas microstability is a static concept of stability, macrostability is a dynamic concept.

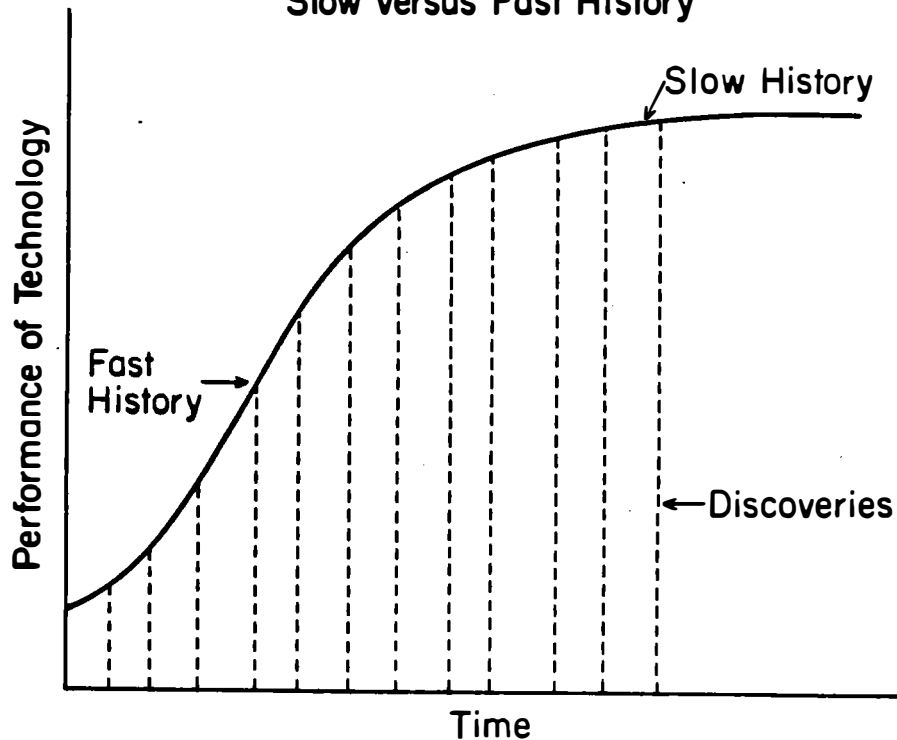
It is important to recognize, however, that the difference between micro and macrostability is a matter of degree rather than of kind. Inasmuch as some departments are more bureaucratically

rigid than others, with lawyers and accountants playing larger roles, no firm enjoys 100 percent macrostability. And inasmuch as some industries exhibit a smaller ability to adapt to new circumstances than others, no economy enjoys 100 percent macrostability. Conversely, even the British economy cannot be described as an economy with 100 percent microstability: if it had a zero capability to deal with new circumstances, it would have collapsed long ago. And though the U.S. economy is now a less dynamic economic system than it was twenty years ago, as compared with Britain it still enjoys a relatively high degree of macrostability. For example, except during the Great Depression and World War II, British working class people have steadfastly refused to move in order to take better paying jobs. And though we are rapidly catching up--more than 4/5 of British firms are managed by lawyers and accountants. Nevertheless, if the following argument is correct, both the productivity decline and the development of an economy highly sensitive to inflationary and deflationary shocks can be understood only in terms of an economy which by featuring microstability more and more is losing its macrostability.

I.

What, then determines whether economies will have a relatively high or a relatively low degree of macrostability? To consider this key question, it will be useful to refer to the familiar S-shaped curve relating the performance of a technology to time (Chart I). How is the performance of a technology

CHART I
Slow versus Fast History



to be measured? Ideally, we would like to have a single measure that took into account both reductions in costs and improvements in quality. However, since it is practically impossible to devise such a measure, we must choose between a cost or a quality measure, depending upon which will provide the most accurate estimates.

If the performance of a technology is appropriately measured then the typical picture is as shown—one in which a period of fast history is followed by a period of slow history. The dashed lines represent discoveries such as the Model T Ford or the planar transistor—which when viewed as isolated events were quite unpredictable. On the basis of my definition of "dynamic," both fast and slow history are to be regarded as dynamic processes: both involve adapting to new circumstances by discovering new alternatives. The essential difference is that inasmuch as fast history involves dealing with new circumstances at a rapid rate of improvement, it requires a higher degree of macrostability.

Why then, does fast history sooner or later turn into slow history? According to conventional wisdom, after the promising ideas for making non-incremental advances have been exhausted, entrepreneurs have no alternative but to turn to bringing about incremental advances. However, I do not subscribe to this line of reasoning. In the first place, how soon a technology runs into diminishing returns depends on how broadly or narrowly it is defined; and it is man and not nature who determines how broadly it is defined. For example, if computer technology had

been defined to exclude the possibility of semi-conductors, today we would be witnessing slow history in computer technology. In the second place, if ideas represented the main shortage, then when revitalizing discoveries were made--discoveries such as the Bessemer process in steel or the jet engine--then we would expect that major firms in the industry would account for their share of such discoveries. But of fifty cases I have looked into, in not one did a major firm in the industry bring about a revitalizing discovery. They were made by firms in another industry, by new firms in the industry in question, or occasionally by university laboratories; but never by major firms in an industry featuring slow history. Finally, when challenged by newer technologies, other technologies have shown impressive gains in the rate of improvement; railroads and cotton textiles, for example.

The principal reason why technologies come to be defined very narrowly and why the rate of progress eventually slows down is not because of a shortage of ideas, but rather because of a shortage of hidden-foot feedback. Hidden-foot feedback is the feedback a firm obtains from its rivals; and it is measured in terms of changes in market shares. Industries with little or no rivalry, according to this measure, are industries in which firms by developing products which are only trivially different from each other, impose no risk upon each other. But inasmuch as what is a technological risk to one firm in an industry, is a competitive risk to another, the more technological risk-taking that is undertaken in developing products with nontrivial differences,

the greater will be the changes in the market shares and the more effective the hidden foot. And when 40 percent of a well established market can be lost almost overnight, firms cannot afford to wait for a crisis. They must do their long-range crisis prevention planning every Monday morning.

In principal, of course, all firms in an industry might aim for equally ambitious advances--and all might be equally successful, or equally unsuccessful--with market shares remaining more or less the same. But, statistically speaking, the probability of such an occurrence is something like one in a million. Almost invariably, the larger the advances that are sought, the wider will be the differences between more and less successful R & D projects, and the larger will be the change in market shares.

Why does the push of the hidden foot play a much more important role in a dynamic economy than the pull of the hidden hand, that is, the pull of profits? If the gains from making large advances could be accurately predicted (if the hidden hand played the highly predictable role it is alleged to play in the economic textbooks) no hidden foot would be required. The firm would only have to decide whether the possibility of a greater profit warranted a greater risk. However, in the real world luck plays such an important role in major advances that reliable predictions of profits involved in major technological opportunities simply cannot be made. What is as predictable as death and taxes in an industry with large changes in market shares is that if one firm is not

successful, another will be. Hence, if firms hope to survive in such a dynamic industry they must either be willing to take risks when they cannot calculate the odds of being successful, or face the more certain risk of being driven out of business. And it is for this reason that the push of the hidden foot is the main driving force of dynamic capitalism.

What is most important, if such firms are to put the odds on their side, is to ask themselves searching questions about their technological opportunities, and tough questions about the need to revamp their organizations in order to exploit these opportunities (i.e. the entrepreneurial function). Moreover, this question-raising function has a major influence on the internal characteristics of organizations. In such organizations there is likely to be a good deal of feedback in the form of pecuniary and nonpecuniary for individual creative accomplishments. Generally speaking, salaries in such organizations are based on creative accomplishments; and are not highly correlated with either age or administrative position. In turn, such a reward structure drives organizations to be highly interactive both internally and with their customers and with universities--so interactive the authorship of particular discoveries is always in dispute. Consequently, necessity in the form of the hidden foot makes for highly interactive questioning organizations, and in doing so, makes such organizations much more likely to be favored by chance.

In short, my explanation of fast history is a statistical explanation; necessity, in the form of the hidden foot, makes for

entrepreneurs who ask burning questions, and to search for answers to these questions, highly interactive organizations. This activity, in turn, results in a lot of luck, both good and bad. But inasmuch as only the good luck gets recorded, fast history is made to seem so smooth, it seems to have been preordained. Thus, to explain rapid economic progress we need a model which is neither completely deterministic (because it fails to recognize the entrepreneurial question-raising activity and the associated role of luck) nor completely stochastic (because in failing to perceive that man's destiny is not entirely determined by God's throwing dice is simply another brand of determinism)--but, rather, which acknowledges a reciprocal relationship between necessity and luck.

The principal factor in determining whether or not an industry will generate relatively much or little feedback is the ability of new firms to enter the industry. If they hope to become a major factor in the industry, new firms obviously have an incentive to ask themselves tough and searching questions. And in doing so, they not only contribute to making more than their share of new discoveries--they prevent existing firms from resting upon the basis of their previous accomplishments.

However, during the evolution of a technology, both scale economies and various types of vertical integration become much more important--and with the consequence that the cost of entering the industry increases by one or two orders of magnitude. This is the essential reason why the rate of entry almost always slows down--and the essential reason why fast history is sooner

or later superceded by slow history, when because of the relative absence of hidden-foot feedback, chance plays a smaller role.

II.

Why does a trend towards microstability--as measured in terms of a larger and larger proportion of slow history industries--jeopardize a country's long term macrostability, as measured by it's rate of productivity gain? If it costs only one twentieth as much to bring about an incremental advance as a discontinuous advance, and if twenty small steps brought as much progress as one large one, then slow history would not be expensive history, and the rate of productivity gain need not decline. However, the truth of the matter is that making a single small step is likely to cost as much as, or more than, making a large one, which means progress via the slow history route is likely to be something like twenty times as expensive.

What makes incremental progress so slow and expensive is that not pressed to ask searching questions, highly specialized organizations only search where the veins of ore are very thin. Moreover, microstability becomes a way of life. Instead of accepting personal responsibility, people impose on themselves all sorts of rules and regulations, so, if anything does go wrong no one can be blamed; and the degree of internal bureaucracy is further enhanced by the formation of tight internal alliances dedicated to the preservation of the status quo. From the point of view of an insider who, at best, can have only a marginal impact

on his organization, acting to conserve his power while putting on a great show of looking busy is eminently rational behavior. And it is this kind of bureaucratic environment that makes incremental progress so slow and expensive.

Many economists seem to assume that because private firms obey the discipline of the marketplace and public organizations do not, the difference between them is the difference between day and night. This, however, is simply not true. If bureaucratic behavior is defined as highly predictable behavior that makes organizations highly insensitive to feedback, then we can expect to observe an entire spectrum of private firms from highly adaptive to highly bureaucratic; and in industries with little or no rivalry there is no real difference between public and private organizations. For example, in the degree of bureaucratic behavior they display, banks, public utility companies, and steel companies are not very different from the Defense Department, the Post Office Department, or the Environmental Protection Agency.

Although the EPA is not absolutely unique in its degree of bureaucratic (i.e. predictable) behavior, because of its impact on the dynamic stability of the country it does deserve special mention; that is, it has not only contributed to a slowdown in productivity gains not only as customarily measured, but also, to making progress in lowering the rate of environmental degradation much lower than it otherwise might be. The essential reason goes back to the Congress which seemed to feel that cleaning up the environment was

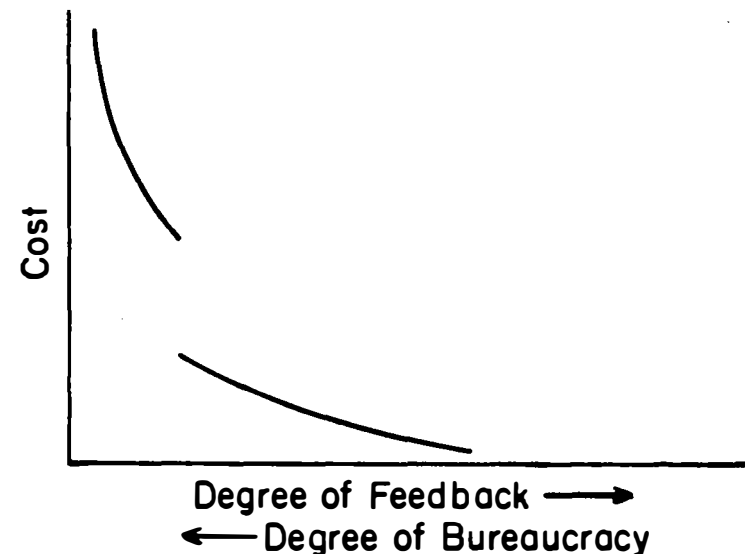
like a supposedly one-time task of cleaning up a dirty room. And the authors of the Clean Air Act assumed that by hiring droves of lawyers to oversee that task, they could, in effect, repeal the second law of thermodynamics. Unfortunately, however, new things are being learned almost daily about how to increase the rate of productivity as it applies to lessening the rate of environmental degradation. But because the EPA bureaucracy is almost totally incapable of dealing with new circumstances, progress is both terribly slow and terribly expensive.

To summarize: There is a longer-term tradeoff between the degree of hidden-foot feedback and the cost of making progress. This is the tradeoff shown in Chart II. When the entry of new firms creates a good deal of hidden foot feedback, the cost of progress will be relatively small. On the other hand, when because of a shortage of such feedback, organizations impose a high degree of bureaucracy upon themselves, the cost of progress is likely to be very large. It should be apparent, therefore, that a decline in feedback and an increase in private and public bureaucratic behavior threatens the longer-term stability of the economy by making the role of productivity gain smaller than it otherwise would be. And the essential reason that the long-term rate of productivity gain in the U. S. is falling is that we're being driven up to the top portion of this discontinuous curve.

III.

A serious decline in feedback not only jeopardizes the long-term economic stability of an economy, it also jeopardizes

CHART II
Degree of Feedback versus Cost of Progress



short-term stability. In particular, it makes for an economy in which larger and larger recessions are required to restrain the rate of inflation. Leaving the inflation issue aside for a moment, I want to point out first, that an economy in which a significant number of industries are generating a large amount of feedback helps to minimize the amplitude of business cycles because those industries that generate a good deal of feedback are likely to suffer less from economic downturns than industries that do not.

To test this and another hypothesis, over the summer I was engaged in a statistical performance of some 500 manufacturing industries. The study was based upon unpublished data for these industries supplied by the Bureau of Labor Statistics. The data base included information on output, productivity, prices, unit labor costs, and wage rates; and covered the period 1958 to 1976. In order to analyze the data, we divided industries into three groups based upon the performance in bringing about productivity gains during the first half of that period. The high performance group was defined as those industries whose average rate of productivity gain during the first half of the period was more than one standard deviation above the average, and included industries such as semi-conductors, computers, man-made fibers, pharmaceutical preparations, fertilizers, radio and TV sets, household refrigerators, and malt beverages: industries characterized by a relatively high degree of rivalry. The low performance group was comprised of industries whose productivity gains were one deviation below the average; and it included industries such as frozen fruits, men's and boys' suits and

clothing, newspapers, books, metal cans and primary lead: industries characterized by very little rivalry.

As Chart III shows, until the 1973-1974 downturn, recessions in the high performance group of industries were almost entirely recessions in their rate of growth. There are two reasons why, by being less subject to downturns, such industries contributed to the overall stability of the economy. First, firms who have to deal with a large amount of feedback more or less continuously, and who experience sharp downturns even when the economy is highly prosperous, are better able to deal with recessions. Second, by virtue of having an advantage over less dynamic firms in being able to recognize a potential unsatisfied demand for new products, such firms tend to be involved in activities that are less subject to downturns. For both of these reasons, the regions of the country less affected by serious downturns are those possessing industries characterized by a relatively high degree of macrostability; for example, California during the Great Depression.

However, as Chart III shows, during the 1973-1974 downturn, the high performance industries experienced a very significant decline in output; in fact, a decline quite as serious as in the medium and low productivity industries. And their productivity performance began to display a more cyclical pattern. Indeed, in being highly associated with the business cycle, their productivity performance began to resemble that of the medium and low performance groups.

As Chart IV shows, in manufacturing industries as a whole, the rate of productivity increase tends to slow down during economic recoveries, in anticipation of a general decline in out-

CHART III

HIGH PRODUCTIVITY INDUSTRIES OUTPUT VERSUS PRODUCTIVITY

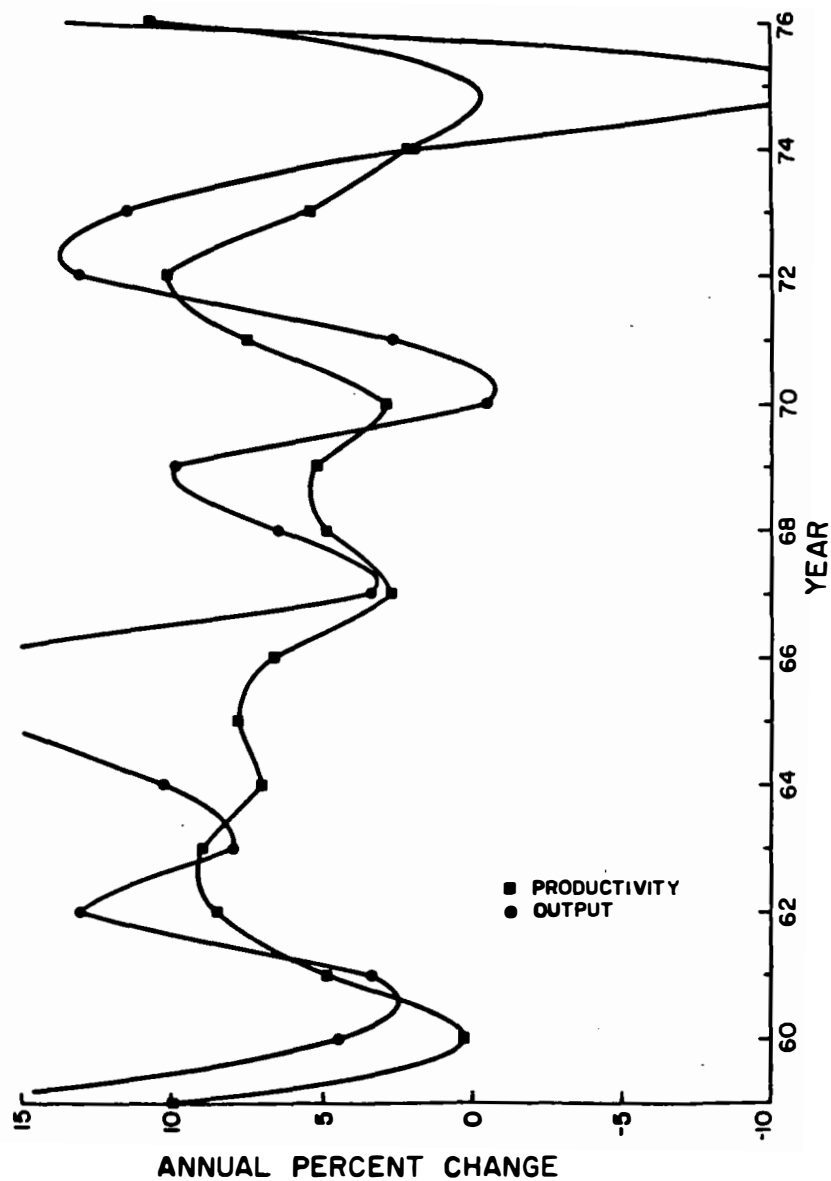
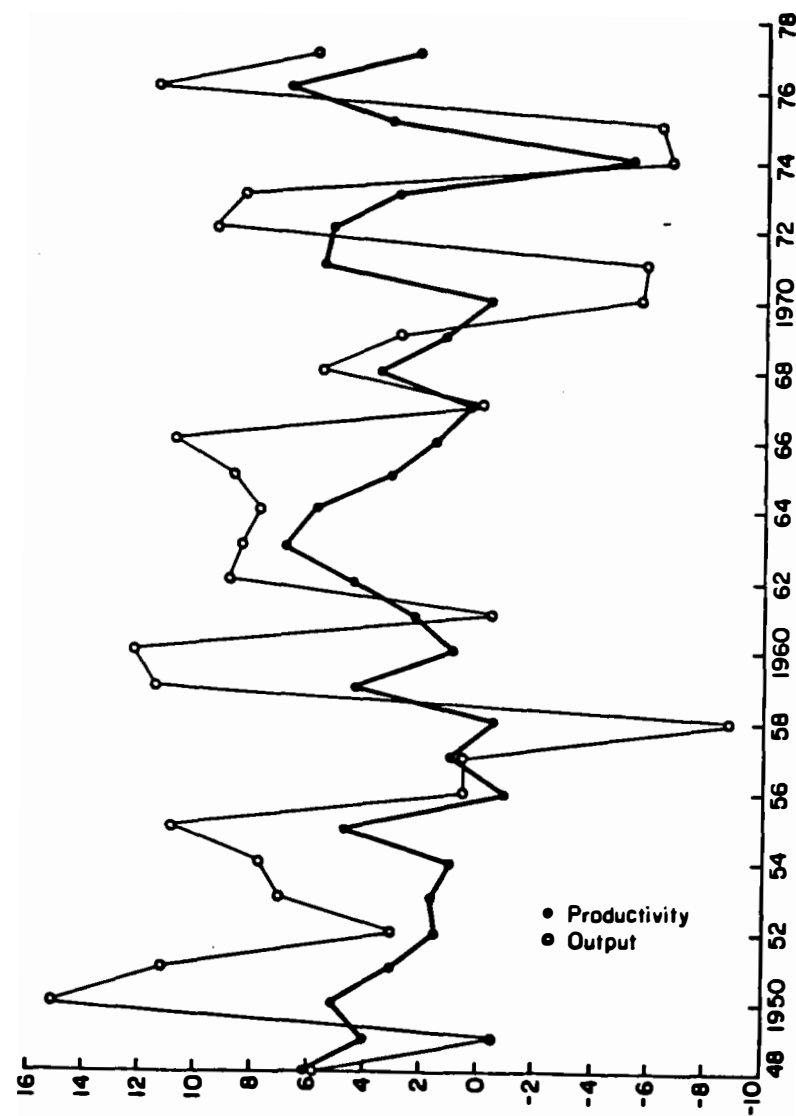


CHART IV

Changes in Productivity and Output, 1948-1977



Source: Bureau of Labor Statistics

put; and to increase during recessions; in anticipation of an upturn in the level of output. Thus, the 1958, the 1970, and the 1973 downturns were preceded by periods in which the trend of productivity gain was generally downward. Moreover it should be noted that this pattern of behavior is not peculiar to the Post World War II periods. Since 1890, movements in productivity in manufacturing as a whole have been highly associated with the business cycle--and in three out of four cycles, movements in productivity have provided good lead indicators of both downturns and upturns.

How is this to be explained? It is true, of course, that capacity constraints become more and more important during an upturn, and that to further expand the labor force, it is necessary to draw upon marginal workers. It is also true that once the downturn starts, there is a tendency not to reduce employment as rapidly as output declines. However, such an argument cannot explain why the rate of productivity increase (as distinct from the absolute level of productivity) rises above zero during upturns, thereby providing the economy with a higher absolute level of productivity that it had before. As Chart IV shows, only in the 1973-1974 downturn did the rate of productivity gain go below zero--and in general the most impressive advances in the rate occur while coming out of recessions.

My explanation of such behavior is simply this: In industries in which the hidden foot plays a relatively modest role, negative feedback in the form of lower profits occurs mainly during recessions. Therefore, it can be predicted that

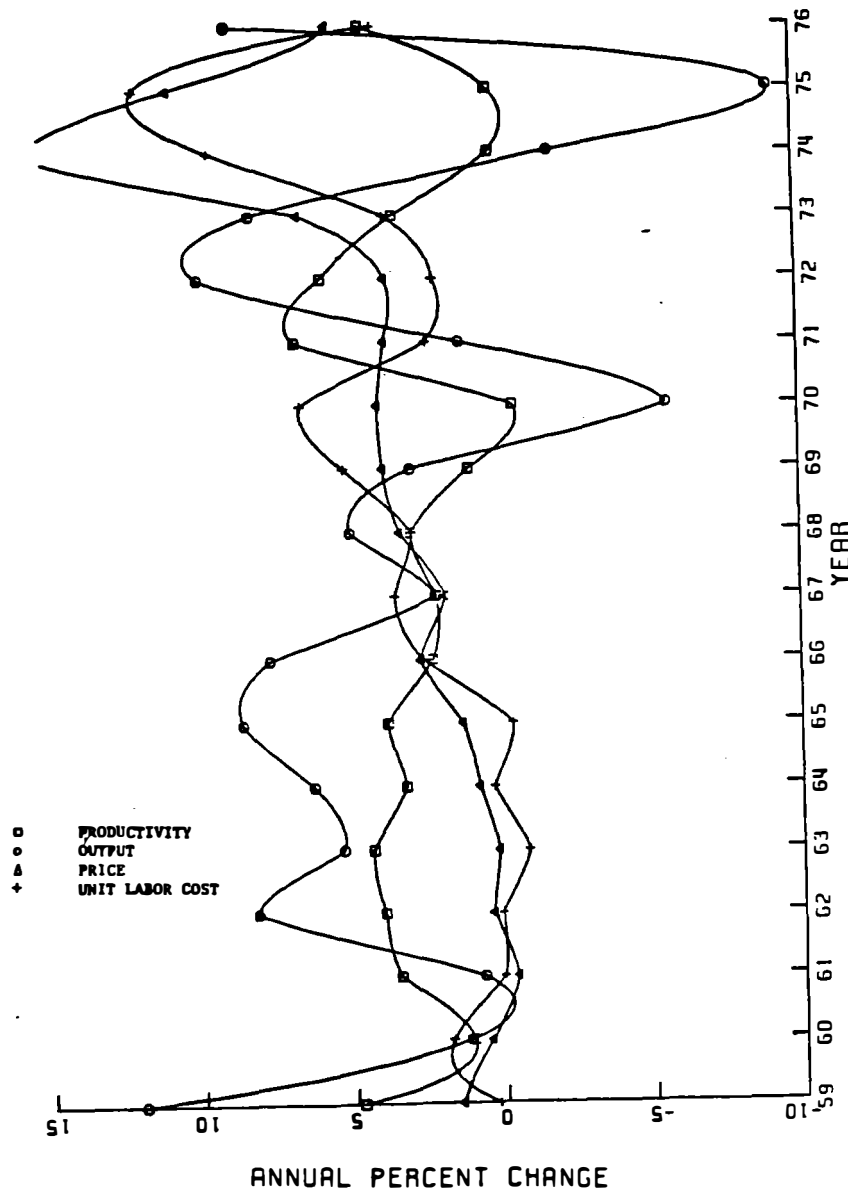
their search for ways to improve productivity will be widest when negative feedback is maximized and narrowest when it is minimized.

Thus even leaving the question of inflation aside, it should be apparent that a decline in feedback will jeopardize the short-run stability of the economy. The less firms come to depend upon each other for their negative feedback, and the more they come to depend on economic downturns the greater will be the economic downturns.

IV.

Finally, I want to show how an economic system obsessed by the desire for microstability tends to generate a maximum rate of inflation while we are heading into a recession, thereby greatly complicating the task of controlling inflation. This tendency was most strikingly exhibited during the downswing which began in 1973, and ended in 1975, when the rate of inflation in manufacturing increased from about 3 percent annually to over 11 percent annually (Chart V). True, something like one-third of the overall increase in prices can be attributed to the increased cost of oil inputs but after taking OPEC actions into account we are still left with the conclusion that in manufacturing the rate of inflation more than doubled during the downturn, and abated only after recovery was well underway. Moreover, it should be noted that this sort of price behavior is not new. During the recession beginning during the late 1960s the rate of inflation in manufacturing doubled. In fact, during each major downturn since World War II, prices behaved less flexibly than in the last.

CHART V
PERFORMANCE OF MEDIUM
PRODUCTIVITY INDUSTRIES

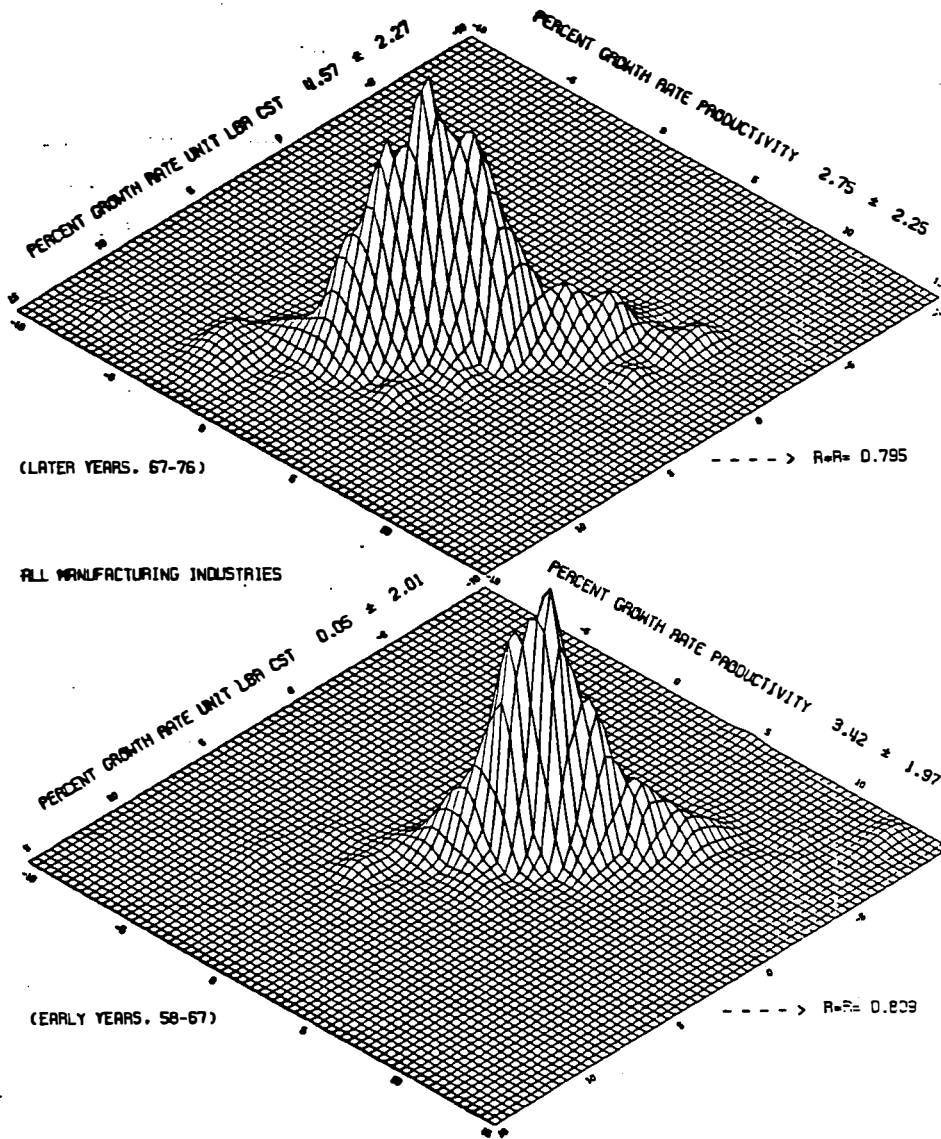


How is this price behavior to be explained? In the first place, as I have already pointed out, there is a tendency for the rate of productivity advance to begin declining before output has reached its peak, and to continue to decline during the downturn.

Closely associated with this tendency for unit labor costs to increase during downturns (curve labelled +). Unit labor costs are defined as the average costs of producing a particular volume of output; and in manufacturing they account for roughly 75 percent of all costs. Now, unit labor costs reflect changes in wage rates as well as changes in productivity. If productivity rises more rapidly than wage rates, unit labor costs will decline; if hourly wage rates rise more rapidly than productivity they will increase. Nevertheless, the cyclical swings in productivity have been so large that their influence upon unit wage costs has been the dominant influence. This is indicated by Chart VI, which shows the relationship between changes in productivity and changes in unit wage costs. For those of you not familiar with this type of diagram, I want to point out that it is constructed simply by counting the number of observations in each cell and by making the heights of the contours proportional to them. Its main advantage over the familiar scatter diagram is that it better permits us to see the changes which have occurred in a distribution between two time periods. In this particular case, the global correlation coefficient, R^2 , remained about the same in both periods; and the principal change was an extension of observations along the correlation line; that is, relatively high negative productivity rates became

CHART VI

PRODUCTIVITY VS UNIT LABOR COST



associated with very large increases in unit wage costs--and very large productivity rates became associated with small increases in unit costs.

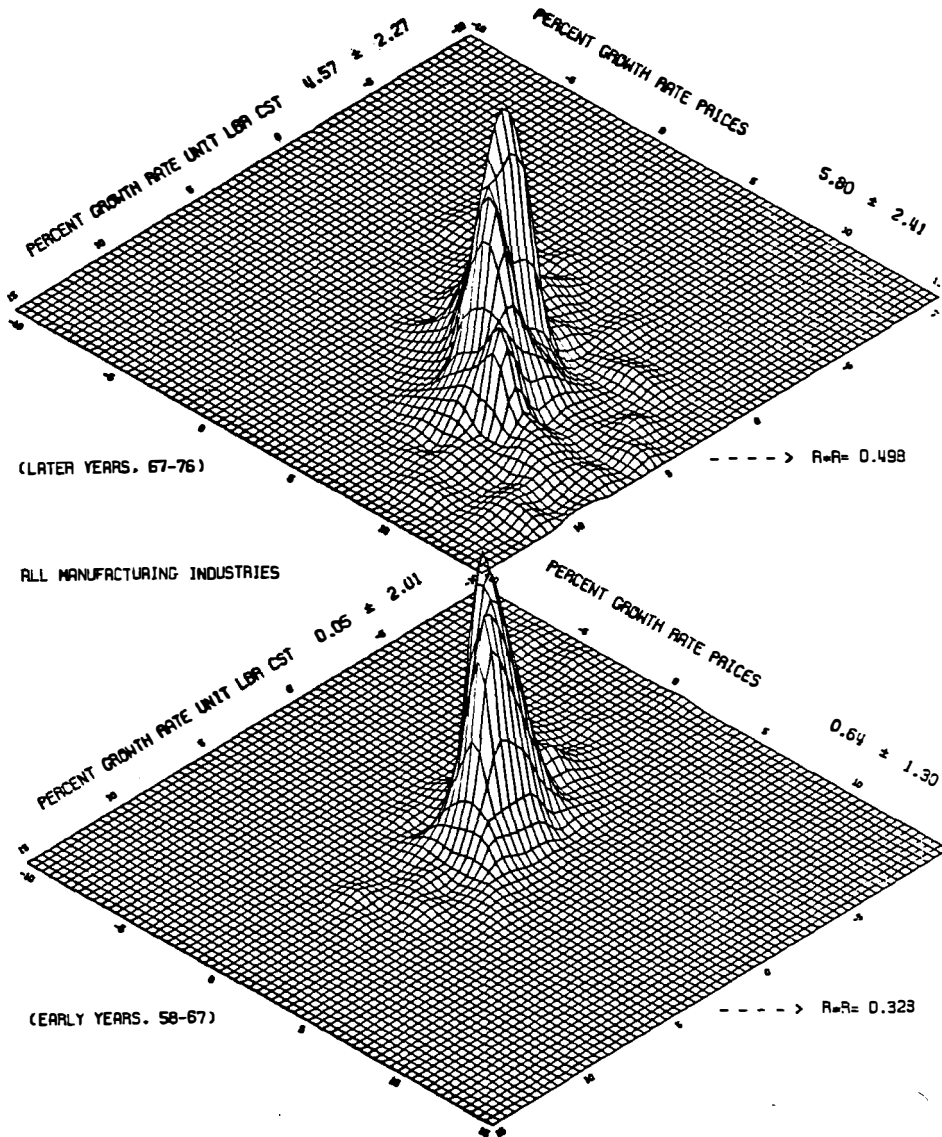
In short, the picture is almost the direct antithesis of the conventional wisdom in economics. According to most of the macro models, steady advances in productivity occur routinely--and increase in wages during periods of high employment lead to higher prices. However, as I already have pointed out, during the last two downturns, the maximum rate of inflation occurred not when unemployment was relatively low--but, rather, when it was relatively high. And because cost-of-living allowances have played an increasingly important role in wage contracts, wage rates too have become relatively insensitive to the rate of unemployment. Thus, during the past two recessions, there was no significant reduction in the rate of increase.

At the same time as movements in prices have become less and less sensitive to general business conditions, they have become increasingly sensitive to costs. As Chart VII shows, from the period 1958-1967 to the period 1956-1976, the coefficient of correlation (r^2) between unit wage costs and prices moved up from .3 to .5, with very large increases in unit costs tending to be associated with large increases in prices. Moreover, after adjusting for increases in the cost of oil inputs, the coefficient of correlation during the latter period is almost .65.

We all know that if business firms are to survive in the longer-run, prices must cover costs. But apparently business firms would like, if they could, to set prices in a manner to

CHART VII

MEAN TIME RATE CORRELATION OF PRICES
VERSUS UNIT LABOR COST



balance their budgets at each point during the business cycle. Just as R & D projects are managed in a way to insure a high degree of predictability in the short-run, so are prices. And both reveal an economy possessed with a quest for microstability.

The increasing insensitivity of wages and prices to economic downturns is, of course, but another indication of the development of highly bureaucratic business firms and labor unions. In industries featuring a good deal of rivalry, there are typically large differences in profit rates, and for fear of putting less profitable firms out of business union leaders in such industries have been very statesmanlike in their wage demands. Consequently, during the period 1958 to 1967, wages in the high productivity industries increased by no more than wages in the medium and low productivity industries. And when wage and price escalation started in the late 1960's, it was industries like steel that led the way. It can be agreed, of course, that were it not for the large increase in public expenditures during the late 1960s, the inflation might not have started. But it also must be agreed that an economy in which highly bureaucratic business firms and labor unions thrive because of a shortage of feedback is an economy highly vulnerable to inflationary shocks.

Moreover, once inflation has begun, such price and wage behavior makes for deeper recessions, because much more stern action must be taken in order to throttle the rate of inflation. Indeed, to many economists a recession with 8 or 10 percent unemployment, needed to avoid an even bigger depression, later no longer seems like the unforgivable disaster it once seemed.

Now, it is true, of course, that if during periods of inflation all prices increased more or less equally, and if incomes increased at the same rate as prices, inflation need not make for greater downturns. But as Chart VIII shows, during the period 1967-76, the variance in the rate of price increase was more than double what it was during the period 1958-67. With prices depending greatly on costs, and with large differences in cost increases (owing mainly to differences in productivity) such differences in the rate of price increase are to be expected. Moreover, although the global correlation between prices at output was close to zero during both periods, as the upper left hand portion of the diagram shows, in several industries above average growth in prices was associated with above average declines in output. In other words, while the slow up of supply and demand may be partially suspended during periods of inflation, it may not be entirely suspended. To be sure, the serious offender may not be penalized more greatly than more modest offenders--and the proportion of industries in which offenders are seriously punished is very small. Yet from a macro point of view the effects of such price behavior on output is, I would guess, much greater than would result from the closing down of Chrysler.

Assuming that during periods of inflation there is some large variance in the rise of consumer prices as there is in the rise of manufacturing prices, what can be said about inflation from a consumer point of view? Quite obviously, if consumers are not to be penalized by suffering large declines in real incomes, they must search for bargains much more now than they did say, 10 years

ago. In other words, even assuring that on the average many incomes keep up with prices, during periods of inflation, the consumer must deal with more uncertainty. Thus, because micro predictability cannot be conserved in an uncertain world, the more that business firms try to conserve the microstability, the more uncertainty they introduce into the lives of consumers.

V.

In summary, if my argument is correct, the inability of a dynamically unstable economy to deal with new circumstances can be revealed in several ways, including in the short-run, a relatively low ability to deal with inflationary shocks and recessions, and in the longer-run, sharp increases in the cost of progress and a consequent reduction in the long-term rate of productivity gain.

Given the self-correcting role that feedback plays in other systems, it would be surprising, indeed, if it played an almost zero role in the functioning of an economic system. To be sure, in an economic system negative feedback does not result in the almost automatic self-correcting mechanism as it does in cybernetic system such as steering a ship. Rather, its role is more like that played by feedback in biology--for example, when confronted by necessity chimpanzees can be observed to invent completely new tools for themselves. But the fact that feedback does not play an almost automatic role in economic and biological systems does

not make it any less important.

And it is my conviction that until this role is better understood and more widely appreciated, there is little hope for policy reform in this country. Indeed, unless the stabilizing role becomes to be regarded as a very natural role and unless politicians become something other than experts at removing feedback from an economic system, capitalism will not survive.

VI

Needed Policy Reforms

There are a number of ways to increase the degree of feedback in the economy. These include changes in the tax system, and changes in international trade policy. However, in what follows, I shall concentrate on measures that would increase the degree of risk-taking by changing the structure of industry.

1. Outlawing Mergers Among Large Companies

The conventional arguments against mergers is that they increase the degree of economic concentration, and that in doing so, they increase the concentration of political power. However, this is not my argument. My argument is that in industries in which there is not already a high degree of rivalry, as measured by changes in market shares, mergers will result in a further reduction in risk-taking. Thus, I have no doubt that the large wave of mergers which occurred during the last 15 years has contributed to the productivity slow down.

Because the argument with respect to vertical integration is somewhat different from that for other types of mergers, I shall

start with vertical integration. To introduce the argument, it will be convenient to consider a situation in which there is already a high degree of rivalry--such a high degree of rivalry that every division of the company is compelled to stand upon its own. In this hypothetical state, the engine division of General Motors is interested in making as much money as possible, and because it is, it is quite as interested in selling engines to Ford as it is to General Motors. Similarly, the automobile assembly division wants to buy the best available engine, and really does not care whether it obtains it from General Motors engine division, or from some other company.

With a high degree of rivalry and with each division of the company trying to make as much money as possible, there is, of course, an open question of whether we have vertical integration. Vertical integration as it is usually defined presupposes an effort to coordinate all of the inputs in terms of a single final product. And instead of trying to make as much money as possible, each division is expected to undertake its activities in a manner so as to best contribute to the profit position of the company as a whole. For example, General Motors probably would not favor development of engine technology that promised to make a good deal of its physical capital obsolete. Nor would it favor an engine program which provided a real threat to its administrative hierarchy and was therefore likely to result in huge organizational costs.

Now, if the automobile engine companies were organized in separate firms, the firms engaged in assembling automobiles would probably have the same preferences. But they could not be nearly so

sure that one of another automobile firm would not adopt a superior engine when its survival was threatened. Moreover, should one firm make such an adoption, others would be forced to follow suit. Thus, without vertical integration, there is more uncertainty on both sides of the market. The buyers of progress are more uncertain because firms whose market share is lowest have more ways to improve their competitive position. The sellers of technological progress are more uncertain because from their point of view the opportunities for risk-taking are greater than they would be if they were parts of vertically integrated firms.

In short, in industries with little rivalry vertical integration is a way to protect the firm against risks. And because it provides firms with relatively little ability to deal with uncertainty, it results in a delicate balance of power between firms who develop products which are only trivially different from each other.

Hence if an economy is to continue to generate an adequate supply of negative feedback, mergers of large companies that result in a vertical integration should be outlawed; that is, unless the firms can supply evidence that the various suborganization in the firm are being operated quite independently.

Next, let us consider horizontal mergers and conglomerate mergers. Horizontal mergers result in less risk-taking because they result in fewer decision making centers, and hence with better opportunities for the preservation of a delicate balance of power. As far as conglomerate mergers are concerned, the main argument made

for them is that by diversifying its activities, the firm is better insured against uncertainty. But with the firm as a whole better insured against uncertainty, each division will have a small propensity to engage in risk-taking. If the various divisions are to continue to raise major questions about their technological opportunities, it is necessary to keep the backsides of their management to the fire -- and that is just when conglomerates fail to do.

Hence, there is a powerful economic argument against all mergers among large firms: it reduces the supply of hidden foot feedback. To carry the argument to the extreme: supposing that all firms in the U.S. were organized into one giant merger that was insulated against foreign competition (e.g., as in the Soviet Union). Under this assumption, the economy would generate absolutely no hidden foot feedback. And it follows that the more mergers that are brought about, the smaller will be the supply of negative feedback.

2. Decoupling the Generation of Electricity from Other Activities of Public Utility Companies

This proposal would involve separation of generating electricity from transmitting and distributing electricity, while encouraging independent firms to compete in the generation of electricity on the basis of cost. While there are some outlying areas in which such competition should be precluded, encouraging the need to preserve scale economies cannot be given as a reason for not having such competition. In fact, public utilities commonly buy electricity from each other today.

The importance of such decoupling stems from two factors.

The first is that the incentives of public utility companies to search for low-cost alternatives are probably weaker than in any other industry in the entire economy. Not only is there little or no price rivalry between utility companies, but in normal times, public utility rate-making procedures provide about the same incentives as cost-plus contracts. In times of inflation, the fact that regulatory commissions are loath to pass on cost increases holds prices down. However, public utility commissions do not provide the kind of feedback that would be provided by having independent companies compete on the basis of cost.

The second reason for the proposed decoupling is that, when it comes to developing exotic new technologies, the public utilities are no more capable than the railroads would have been to develop airplanes.

As a consequence of poor incentives and an almost zero ability on the part of public utilities to engage in dynamic behavior, the country has had to pay an exorbitant price for the development of nuclear energy, in terms of both cost and safety. Public utility companies cannot be blamed for all that has happened. They did not develop either the design concepts or the detailed designs for power plants, nor did they establish the safety regulations.

However, the diffusion of responsibility is in part a reflection of the fact that the utility companies do not possess the required competence to play a significant role in the generation of new alternatives.

Consider the very different situation in the field of

commercial aircraft development. Just as safety requirements are imposed on nuclear power plants by a public agency, so are safety requirements imposed on commercial aircraft by a public agency. Moreover, the aircraft companies have no less a stake in the safety of airliners than utility companies have in the safety of power plants. Yet, the aircraft companies themselves have played an important role in the development of safe aircraft. For example, when the British Comet airplane developed serious problems, Boeing sent a team to Britain to help overcome these problems. Is it conceivable that nuclear power companies will ever develop the same competence to deal with their power plant safety problems?

I do not mean to suggest that the United States ought to build more nuclear power plants. In the next decade or two, when it becomes possible to deliver solar energy into a central grid, or when windmills provide an important source of energy, their economical development will also be seriously jeopardized if it is entrusted to the utility companies.

My point is a general one: all new plants for generating electricity should be operated by independent companies. Utility companies' incentives for discovering clever ways to cut costs always have been, and still are, very poor. The principal difference between the past and the present is that it is now more important to provide better incentives. Given this country's predicament in generating an adequate rate of productivity gain, the luxury of making power costs twice as great as they need be cannot be afforded.

3. Putting a Hidden Foot in the Antitrust Laws

If this country is ever to escape from stagflation, entrepreneurs represent an indispensable asset. But, while the United States possesses quite as many entrepreneurs as it ever did, this scarce resource is becoming ensconced in a static equilibrium. There are, of course, a few industries in which the hidden foot continues to play an effective role. However the hidden foot function is being performed today mainly by foreign firms.

An important sense the antitrust laws do contribute to the preservation of a dynamic economy: by preventing price fixing agreements, they prevent negative feedback from being smaller than it otherwise would be. However, if my argument is correct, the main danger this country faces is not from overt agreements, but from firms acting in their own interests in those industries characterized by little or no rivalry. In brief, my argument with respect to oligopoly is as follows: In an industry in which there has been no entry for some years, rational behavior consists of not doing to your competitor what you would not like your competitor to do to you. In particular, firms are not likely to generate surprises with respect to either products or prices, because they are so poorly able to deal with uncertainty that they will not want to provoke a conflict in which they are completely unable to engage. What they will do instead is to develop products that are only trivially different in commodity and price space -- because by so doing, they can avoid unleashing a conflict that well might result in their disaster. Thus, the principal difference between an industry with an effective hidden foot and without an effective hidden foot, is that in the

latter case, uncertainty "space" is very narrow, and having to operate in such a narrow space results in imposing sharp constraints upon engineers, because without such constraints the balance of power might be upset.

The problem, therefore, is how to change the antitrust laws to discourage behavior resulting in trivial differences in prices and products and to encourage the generation of a wider diversity of ideas. In other words, the problem is how to create better incentives for dynamic behavior.

As matters stand today, the incentives provided by the antitrust laws are better calculated to minimize risks in the legal profession than they are to encourage risk taking in the business world. Lawyers feel more at home with legal conspiracy theory than they do with economic theory, and they tend to specialize in cases for which they are best prepared. Consequently, when business firms ask their legal counsels in which kind of behavior they can engage without risking an antitrust suit, the normal answer is "Be just a little different, but do not collude." Providing better incentives for competitive behavior requires changing the antitrust laws so that firms seeking advice on antitrust matters will be told the following, "We know that if you collude, you are in real danger. And we also know that the more your products and prices resemble those of your competitors, the greater is the danger of an antitrust suit. But we cannot tell you how far you can go with respect to parallel behavior. Just as Presidents have to operate within a broad band of uncertainty in predicting how far they can go before being accused of an impeachable offense, so will you have to operate within

a broad band of uncertainty."

How might the Antitrust Division of the Justice Department (or its successor) provide the required incentives? The principal criterion for bringing antitrust cases would relate to both the performance of an industry and the conduct of firms within that industry. Suppose that over a period of say, 3 years the industry exhibits the following performance: a) relatively poor productivity gains coupled with b) a diminishing ability to engage in international competition, which cannot be attributed to dumping. And further suppose that the behavior of this industry features only trivial differences with respect to prices and products. An industry that exhibited such performance and such behavior would be in the same danger of having the largest firms in the industry broken up and provided with new managements as would a motorist who exceeded the speed limit would be of a fine. However, no attempt would be made to precisely define the point at which dissolution of the major firms in the industry would occur because such a definition would provide incentives for minimum acceptable performance. Therefore, to maximize the incentive effect it is desirable to leave some ambiguity in the laws.

This is not to say, however, that cases against violators would be brought without reference to the consumer. The ultimate test of pursuing a diversity of technical approaches must be in terms of potential consumer benefits. And there are some cases in which the generation of a wider diversity of ideas would provide no important consumer benefits; high fidelity equipment for example. On the other hand, in a whole number of industries a higher degree

of dynamic behavior, particularly if it resulted in reducing costs, could result in important consumer benefits. For example, more rivalry in the steel industry easily could lead to a 20 percent reduction in costs (measured in real terms). And rivalry in the generation of electricity easily could result in costs being no more than half of what they otherwise would be.

The antitrust laws also should make illegal the practice of attempting to maintain standard markups over costs, in poor as well as good times. Such practices indicate a high degree of insensitivity to feedback and not only contribute to inflation but in being like the pricing practices employed in the Soviet Union are fundamentally inconsistent with the preservation of a dynamic economic system. Curiously enough, while the Soviets are currently introducing incentives to discourage such accounting practices, and to encourage dynamic efficiency, we are moving in the opposite direction!

One serious objection to tests that leave a good deal of ambiguity in the antitrust laws is that such ambiguity will provide an open invitation to nonenforcement. Indeed, from the point of view of maximizing the probability of enforcement, the ideal measure of competition would be a set of concentration ratios that left no more ambiguity than the speed laws; and which could stand as immutable truths for all time to come. However, while the ultimate purpose of the antitrust laws is the protection of the consumer, what needs to be done to best protect consumer interests is constantly changing. For example, when it was ascertained that higher energy costs threatened the well-being of the consumers,

one of the first questions that should have been asked is "Do the incentives now employed in the public utility encourage cost minimization -- and if not, what should be done?" Likewise, ten years ago it should have been appreciated that there was so little rivalry in the automobile and steel industries so as not only to jeopardize the interests of consumers, but also the stability of firms within those industries. And if cases could not be brought against stagnating industries under existing laws, the laws should have been changed. Moreover, it also must be recognized that in one important respect, at least, economics is like physics: as yet, not all the laws are known. Therefore, as more and more and more is learned about economic reality, including the role played by feedback in promoting economic stability, the laws to promote competition will have to be changed so they can incorporate the best economic thinking of the times.

In order to assure that a greater degree of dynamic behavior is brought into the promotion of competition, there is an obvious need to bring a much wider diversity of people into both the agencies engaged in bringing antitrust cases, and the special courts set up to decide such cases. Engineers and other technical specialists will be needed to distinguish between decorative lies, and genuine improvements in quality. Because neither lawyers nor economists have much experience in risk-taking, successful entrepreneurs who came from highly rivalrous industries could play an important role. For example, David Packard understands much about the workings of competition that is known neither to economists nor lawyers. And above all, an agency charged with promoting

competition should contain at least a few chemists whose specialty is deeply understanding the implications of the second law of thermodynamics. Inasmuch as legal and economic thinking is of the flavor of the first law of thermodynamics (in which nothing changes), such thinking is required to insure a reasonable balance of ideas. Thus, the principal that diversity contributes to stability -- a principal that is the heart of Thomas Jefferson's concept of democracy -- should be brought into the agencies bringing and deciding antitrust cases.

There are, of course, a few old-fashioned Blackstone lawyers who can be counted upon to resist these changes. Fortunately, however, the legal profession contains a wide diversity of people -- and it is hoped that at least a few of them will recognize what is at stake.

Finally, to anticipate one question that is often asked: Why try to save stagnant industries -- why not let foreign competition drive firms in such industries out of business? Part of the answer is that such a policy would result in a very serious rise in chronic long-term unemployment. When industries are highly rivalrous, some firms will experience "prosperity" while others are experiencing "recession," which means that while there will be unemployment in such industries, it is short-term frictional unemployment. Moreover, more often than not, total employment opportunities in a highly rivalrous industry like computers or semi-conductors will be expanding. On the other hand, when workers in the steel industry are unemployed by foreign competition, this results in entire communities being faced with chronic unemployment problems.

The other part of the answer is that the American public

will not long tolerate such unemployment. Indeed, it can be predicted that within relatively few years there will be a clamor for protectionism such as occurred during the 1930s -- and that as we move towards a greater degree of protectionism so will other countries.

It is to avert such a catastrophe that an entirely new approach must be adopted for the promotion of competition.